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Developing Diversity and Inclusion Initiatives and Measuring the Effects of a Pandemic in a Civil and Environmental Engineering Department

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Dr. Stephanie Lezotte currently serves as the Assistant Dean of Graduate Studies at Rowan University. She received her Ph.D. in education, with a concentration in postsecondary and higher education. Using organizational theory, she is interested in systems and structures that contribute to the oppression of underserved and underrepresented college students, particular STEM students. She is active in the American Educational Research Association (AERA) and the Association for the Study of Higher Education (ASHE).

Developing Diversity and Inclusion Initiatives and Measuring the Effects of a Pandemic in a Civil and Environmental Engineering Department

Abstract

The Civil and Environmental Engineering (CEE) Department at Midsized Northeastern University was awarded The National Science Foundation's Revolutionizing Engineering and computer science Departments (RED) grant in 2016 with the hopes of allowing engineering programs to improve the inclusion of minorities over the course of five years. The CEE Department used this opportunity to create a research group called Revolutionizing Engineering Diversity (RevED) that focuses on all underrepresented and underserved groups. The researchers used the grant to help change admissions as well as incorporate inclusive pedagogical practices. Currently, RevED is in the fifth year of the grant and has since spread out to utilize the Engineering Education Department and the Faculty Development Center to help broaden the impact of the grant to other students outside of the CEE Department. The RevED researchers were successful in helping develop a certification program for faculty and staff members to participate in. While there have been positive developments, the research group had to look at the effects of COVID-19 on the lives of students. RevED has utilized data regarding the impacts of the pandemic and will be looking to further develop insight on student experiences. While the poster will feature information on the changing student demographics and student perception of the climate of diversity, the impact of the pandemic will also be shown to see how students are affected and how to better address the needs of underrepresented and underserved students.

Introduction

The National Science Foundation's Revolutionizing Engineering and computer science Departments (RED) grant has enabled Rowan University's Civil and Environmental Engineering (CEE) Department to devote time and effort into improving the climate of diversity and inclusion for the faculty and students in the CEE Department. For the past five years, there have been changes made at the department level and now within the final years of the grant there are initiatives being made to the wider institution. In previous years, the researchers have devoted time to initiatives that include curriculum changes, faculty development, internal research projects, mentoring, and changes in admissions. The research conducted by the Revolutionizing Engineering Diversity (RevED) team are influenced by critical education theory. The RevED team is multidisciplinary and integrates expertise in civil and environmental engineering, sociology, and engineering education. Critical education theory is a framework that utilizes practices in education that enable social transformation in students [1].

Prior to the start of the RED grant, the CEE Department had fewer women and Underrepresented Minorities than the current national average of women and URMS in CEE as reported by the National Academy of Engineering [2]. The grant provided the CEE Department a chance to change its own profile and directly address these issues. The CEE Department will investigate all forms of visible and non-visible diversity. Non-visible elements of diversity are easily overlooked but the RevED researchers will include socioeconomic status, ability, and sexual

orientation, first-generation status, transfer student status, and nontraditional student status [3]. This wide view on underrepresented and underserved student populations require the RevED team to focus on broad research and implementation goals. Over the years, the RevED team has focused on the collection of student and faculty experiences to influence department changes as well as help faculty develop materials that support the development of a warm climate of diversity.

Previous Years Summary

The first year of the RED grant, a survey was given to the College of Engineering to form a baseline of what is the current state of diversity for both faculty and students. Participants were asked to identify how their coursework and daily school lives were focused on diversity and inclusion [4,5]. Since faculty had expressed their interest in learning more about integrating topics of diversity in their curriculum, the RevED team focused on taking steps to engage the faculty of the CEE Department in the form of a workshop that covered topics of diversity and inclusion that could be used in coursework. Personal conversations between faculty and RevED researchers also developed the foundation of what faculty can use to engage students in topics of diversity and inclusion [6]. The RevED researchers also analyzed the SAT scores from previous years' students which helped the Office of Admission to allow the CEE Department to take a holistic approach to accepting students. Mentoring efforts were also initiated with transfer students through the aid of one of the RevED researchers and a broader mentoring of other CEE students through the student chapter of the American Society of Civil Engineers. Mentoring was established as an essential tool for students to stay engaged in their time within the program [7]. These mentoring programs continue on through all the years of the RED grant.

For the second year, another survey was released to CEE students as a means to isolate any experiences and issues that were specific to CEE students. The result of this survey led to the development of interview questions for the third year. The CEE faculty made more curricular changes based on critical pedagogy. The RevED team chose this framework since it allows faculty to think about who is able to participate in engineering and how they can utilize the students' experiences to be included in their own development [8]. The CEE faculty utilized global topics as a means to initiate talks with students about diversity and inclusion. In critical pedagogy, it is encouraged to use non-western examples and the Accreditation Board for Engineering and Technology established that students should have some level of global competence [9,10]. Global examples can be useful for CEE students since there are plenty of historic examples and case studies that can be utilized. The RevED team also held multiple speaker panels to help spread broader awareness of career pathways in CEE and how URM students can succeed in a professional engineering career.

A change in leadership and personnel occurred in the third year but the RevED team was able to analyze student interviews that revealed how our students perceived diversity and inclusion at the university. The analysis of these interviews helped influence the future interview protocol to be used in the fifth year. Curricular development continued with the guidance of student clinic teams. These teams developed small assignments and classroom examples using global examples, domestic examples, and even utilized methods to engage visual learners. This effort is important since the inclusion of students' lived experiences is based in critical education theory as well [8,9]. The RevED researchers connected with the Faculty Development Center on campus as well as the Experiential Engineering Education Department in the third year. This was

done to begin work on the broader changes and impacts for the institution. The RevED team also funded short term faculty projects related to diversity and inclusion as another means to implement broader changes and to pave the way for faculty to apply concepts of diversity and inclusion. These internal research projects also helped in giving recognition to faculty for their efforts and to show how these changes can be implemented for the university and not just the CEE Department.

The fourth year saw the partnership between the RevED team and the Faculty Development Center to continue. This allowed RevED members to serve on a committee to establish a workshop series that will educate faculty and staff on issues of diversity, equity and inclusion that directly impact them and their work at the university. Before the pandemic, there was a steady attendance of faculty and staff at live workshops and that continued into the pandemic as the workshop series made a transition to an online platform. Through the influence of RevED team members, there is now a requirement for tenure and promotion that focuses on training in issues of diversity, equity, and inclusion as well as the implementation of strategies to improve the climate of diversity. The pandemic caused some issues with data collection through interviews and surveys. These initiatives would restart in the Spring semester of 2021 once people become more adjusted to the pandemic's impacts.

The Fifth Year

This year will also see yet another round of qualitative data collection with another round of focus group interviews. Since the first set of interviews showed that students have an awareness of how certain URM groups face issues in engineering, the focus groups will enable researchers to collect subjects for each group. The RevED researchers will utilize the engineering social organizations that are targeted towards URMs, such as SWE, WIE, NSBE, SHPE, and oSTEM. The researchers will also look at transfer students and first-generation students. The focus group interviews will be conducted in the Spring semester and analyzed in the Summer of 2021. The researchers expect that having these specific student groups will provide more information about their collective experience at the institution. The RevED researchers will also reach out to CEE faculty to look into making more curriculum developments. Since the start of the project, the CEE faculty was encouraged to use global examples as a means to get students acquainted with topics of diversity, equity, and inclusion. This next round of curricular development will utilize more domestic examples to address issues in social justice. There are cases, such as the contaminated water in Flint, MI, that can be studied by students to think critically about how engineering affects communities. These cases can show issues in policy making and show how engineering principles can be utilized by those most affected by these disasters.

Another round of quantitative surveys will also be developed to see how students have been impacted by the grant's initiatives over the years. RevED researchers will also be analyzing a separate survey given in 2020 that looks at how the pandemic affected faculty and students. This data can be combined with our research to see how students are being potentially underserved and what obstacles they have to overcome. The survey can also reveal how faculty members still engage with students through the pandemic. In a means to bring about broader impacts, the RevED team will initiate another round of internal research funding for faculty who wish to run projects that concerned with the development of the climate of diversity in the institution. The call for proposals will happen in the Spring semester and projects will run for a short term. Another push for broader impacts includes the connection between this RED team with other

RED teams around the country. There has been a call for all the RED teams that are involved with CEE Departments to come together to share research and develop further research initiatives. Workshops between the RevED team and our colleagues in other institutions have occurred and more are being planned.

Summary

This paper offers a summary of all the current initiatives taking place with the RED research team for the 2020-2021 academic year. The pandemic has delayed some research initiatives in the previous year however the RevED team is pushing ahead with initiatives to understand how the climate of diversity has changed over the last five years of the project. Surveys conducted during the pandemic are currently being analyzed and focus group interviews will be completed in the Spring semester. The RevED team will continue to develop curriculum that helps faculty and students to embrace and consider issues in diversity, equity, and inclusion. This new direction will allow students to think about how engineering can be applied to issues in underserved communities. The RevED team will also initiate another round of funding faculty conducting research in topics of diversity, equity, and inclusion. This round of funding will aid in the development of broader institutional change. A major development being undertaken in the project's fifth year will be the development of greater connections between our institution and other similar RED grant institutions. The collaboration with other RED institutes will allow the RevED team to have deeper connections with colleagues who wish to change their institutions and enable broader research in diversity and inclusion.

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References

1. T.S. Popkewitz and L. Fendler, *Critical Theories in Education: Changing Terrains of Knowledge and Politics*. Psychology Press, 1999.
2. P. Layne, "Diversity by Numbers," *Leadership and Management in Engineering*, vol 1 ed. (4), pp. 65-71. Oct, 2001.
3. D. Riley, A. Slaton, and A. L. Pawley, "Inclusion and Social Justice: Women and Minorities in Engineering." in *Cambridge Handbook of Engineering Education Research*, A. Johri and B. Olds, Ed., Cambridge University Press 2014.
4. B.M. Ferdman, "The practice of inclusion in diverse organizations," in *Diversity at work: The practice of inclusion*, B. Ferdman and B. R. Deane, Ed. New York: Wiley 2014, pp 3-54.
5. R. Jost, *Benchmarks for Cultural Change in Engineering Education*. University of Newcastle, 2004.
6. T. Forin, B. Sukumaran, S. Farrell, H. Hartman, K. Jahan, R. Dusseau, P. Bhavsar, J. Hand, & T. Bruckerhoff, "Rethinking Engineering Diversity, Transforming Engineering Diversity," *ASEE Annual Conference & Exposition*, June 24-28, 2017, Columbus, Ohio. American Society for Engineering Education, 2017.

7. J. L. Mondisa, "Increasing diversity in higher education by examining African-American STEM mentors' mentoring approaches," *2015 International Conference on Interactive Collaborative Learning (ICL)*, Florence, 2015, pp. 321-326.
8. Freire, P. (2018). *Pedagogy of the oppressed*. Bloomsbury publishing USA.
9. D. Riley, "Pedagogies of liberation in an engineering thermodynamics class," *ASEE Annual Conference and Exposition*, June 22-25, 2003, Nashville, Tennessee. American Society for Engineering Education, 2003.
10. Accreditation Board for Engineering and Technology, "Criteria for Accrediting Engineering Programs 2018-2019," [Online]. Available: <http://www.abet.org/accreditation/accreditation-criteria/criteria-for-accrediting-engineering-programs-2018-2019/#program>. [Accessed: January 30, 2019].